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# The Force of Water: Columbia After the Flood

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# The Force of Water: Columbia After the Flood

by Rebecca Johnson

South Carolina Honors College Senior Thesis, December 2015





# The Force of Water:

## Columbia after the Flood











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# Introduction

Nearly two months have passed, and South Carolina is still recovering from the unprecedented inundation of rain that pelted down in early October. Record amounts of precipitation pounded the state over just a few days, resulting in the flooding and erosion of land, the deterioration of public infrastructure and the loss of human life and capital.

The worst of it was in the capital city. Columbia recorded the highest water levels and the highest number of fatalities of all the affected areas. The city's utilities could not handle the torrent of water: dams were destroyed, canals were compromised, roads were decimated and watersheds were ruptured. Houses and lives were claimed as the landscape was rearranged and eroded. The damage incurred over a short 36 hours wreaked economic havoc for governments, businesses and individuals at every level. President Obama declared a state of emergency in the Palmetto State on Oct. 4, but parts of Columbia were inaccessible or still underwater until the third week of the month. The recovery process started with setbacks: boil-water advisories, leaking sewage, overflowing manholes and debris-crowded streets. Those able to help came out full-force, whether lending time, giving money or providing donations. In the week following the flood, Columbia response teams had a lucky problem: the donation centers could not process the influx of donations from all over the state and the rest of the Southeast.

But damage and heartbreak linger even after floodwaters recede. Some repairs will take months, some years. Multibillion-dollar projects – if funded – are an expensive and slow process, amidst a steadily growing metropolitan population and an ever-expanding downtown area. The state and her people face a long road to recovery from the flooding of October 2015 in the reconstruction of its public utilities, waterways and neighborhoods.

The following paper and photographic edition capture just a glimpse of the damage incurred to the Columbia area. This is a compilation of both data and observations: first, with a description of the flood and how it happened, and a short record of the aftermath; then, a summary of the foreseeable repairs needed to reinforce the water and sewage treatment facilities, roads, bridges and homes affected by the floodwaters. The accompanying photographs were taken a few days after, a week after, and a few weeks after the floodwaters receded.





# The Columbia Canal breach

Before the flood



Fig. 1a: SCEMD captures the Columbia Canal before the breach

After the flood



Fig. 1b: SCEMD captures the Columbia Canal Oct. 6, after the breach



# The Flood

The unlikely meeting of three intense storm systems resulted in a rain-soaked eastern seaboard. In the Atlantic Ocean, a strengthening non-tropical storm in the south was met with high pressure from the north. This whirlwind was then confronted by tropical moisture coming from Hurricane Joaquin (see figure 2).

The storm's due course was several hundred miles from the eastern coastline, but it had a monumental indirect effect: a funnel was created within the three systems, creating unprecedented rates of wind and precipitation (Sosnowski). Over the course of a few days, southern states charted some of the highest amounts of rainfall ever recorded. Coasts as far north as New Jersey deteriorated under high tides, gusty winds and crashing waves.

But the hardest hit was South Carolina.

In just three days, from Oct. 2 to 4, as much as two feet of rain had reportedly washed over parts of South Carolina (Sosnowski). The greatest amounts of rainfall were reported in eastern Columbia, continuing southeast from lower Richland County into Calhoun, Clarendon and Sumter Counties, and as far as lower Orangeburg County (see figure 3).

The National Weather Service reports that the most rain fell between the night of Saturday, Oct. 3 and Sunday morning, Oct. 4, recording 21.5 inches at its Gills Creek gauge, 17.7 inches at Fort Jackson, and 13 inches at the USC campus downtown ("Historic Rainfall"). By the tenth day, that month had become the wettest October on record in Columbia, with an average of 13 inches ("Flood").

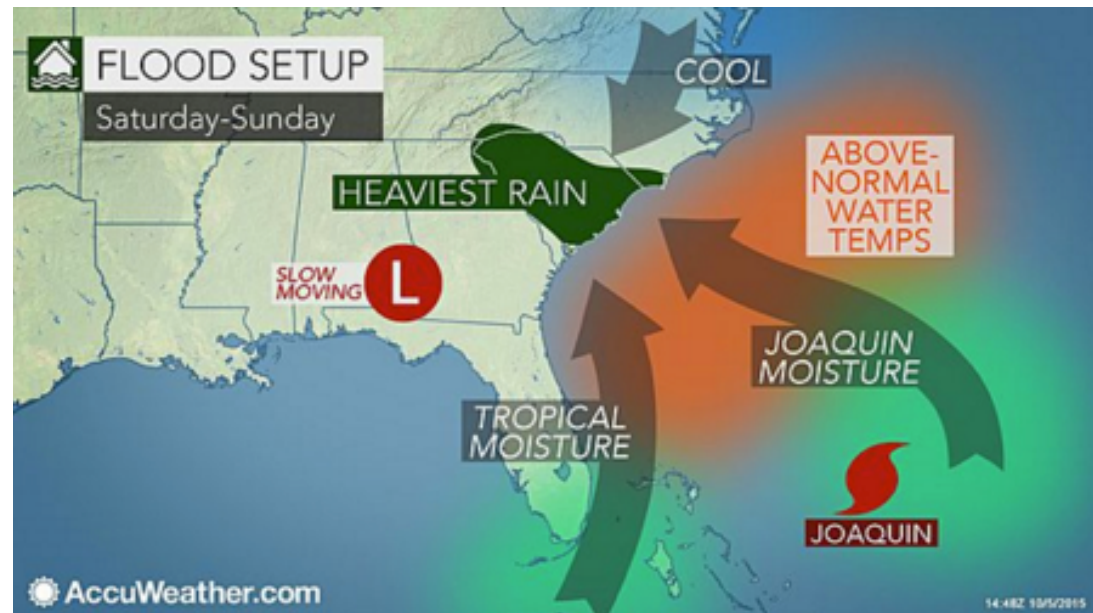


Fig. 2: AccuWeather graphic of the 3-storm system

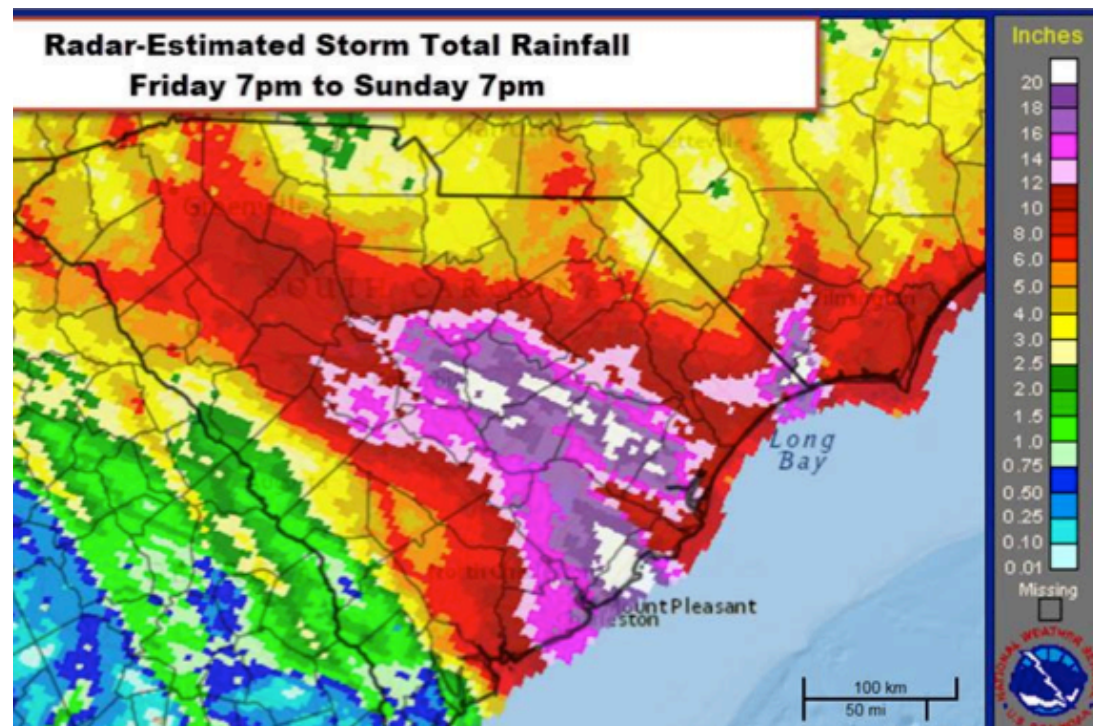


Fig. 3: National Weather Service rainfall estimates for Oct. 2 to Oct. 4 2015. *Opposite page: Columbia Canal, October 2015.*





On Tuesday, Oct. 6, NPR reported Mayor Steve Benjamin used the phrase “1,000-year event” to describe the torrential flooding over Columbia and the rest of the state (Chappell). This terminology is used to describe the chance of an historic flood occurrence for a given area, based on statistical data, rainfall and flood levels. According to Senior Meteorologist Alex

Sosnowski at Accuweather.com, most of South Carolina experienced a once-in-50- to a once-in-100-year event over the course of three days, Oct. 4 to 6. This estimate is based on the “rainfall recurrence period,” an average based on historic rainfall records of a particular area and the likelihood of such an event happening there in a certain time period (Sosnowski).





Dr. Robert Holmes, the National Flood Hazard Coordinator with the United States Geological Survey, says that though some parts of South Carolina experienced 500-year flooding (like in Columbia and Kingstree), most of the state underwent flooding of the 25- to 50-year range. Contrary to popular assumption, the term “1,000-year flood” does not describe the highest water levels in 1,000 years. It means that statistically, there is one chance in 1,000 of a flood of that magnitude or greater occurring in any given year (Holmes).

The USGS measures river and streamflow by state annually. The agency monitors more than 2,000 gauges in South Carolina alone. The USGS-estimated probabilities of 50-, 100- and 1,000-year flood levels, called “flood quantiles,” change each year, because new statistical data is added to the dataset and statistical analysis is run on the new values. With each year’s data, flood estimates become more refined and more accurate, reflecting the occurrence of wetter or drier times (Holmes).

Seventeen of these stream gauges in South Carolina recorded the highest water levels during the October floods taken since the gauge was installed (Feaster). Most of the gauges around the Columbia area offer data from the mid-1980s. The Congaree River is home of one of the longest-running stream gauges in South Carolina, with recordings dating back to 1892, and even flood information for 1852, preserving 123 years of records to compare to the October 2015 data.

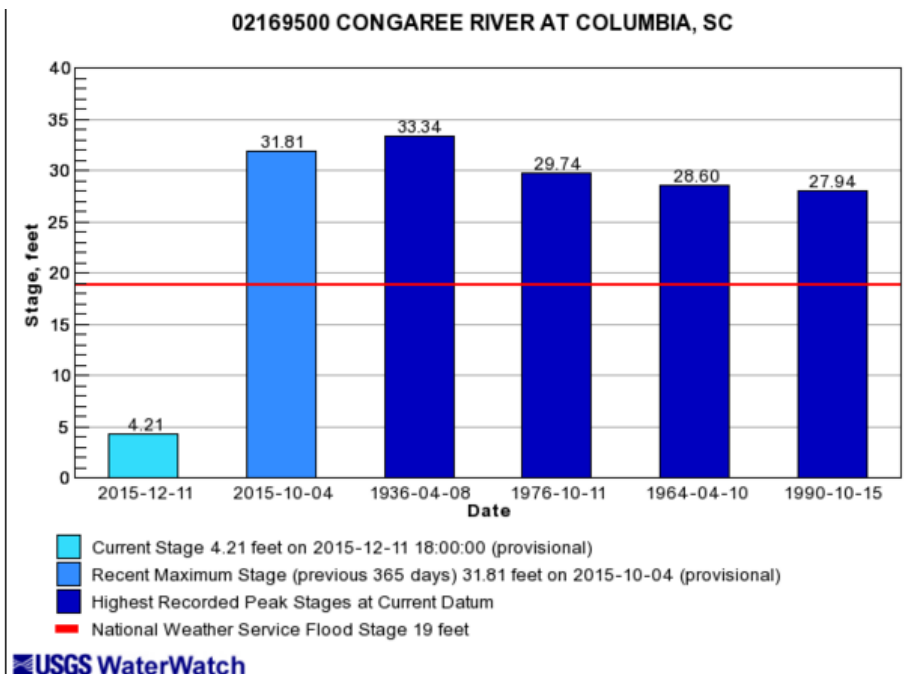
On Oct. 4, the Congaree River gauge recorded 185,000 cubic feet per second, at a peak height of 31.8 feet (see figure 4). This is the eighth-highest recording over the 123-year record, and the highest since 1936. The highest streamflow ever was 364,000 cubic feet per second at a water height of 39.8 feet, taken in August 1908. Eight gauges were destroyed during the flooding statewide, and two in Columbia recorded the highest flow ever (Feaster).





Opposite page and above: The Columbia Canal, built in 1824, is still a focal point of the Riverfront Park. It also generates hydroelectricity for the South Carolina Electric & Gas Co. Right: Fig. 4: USGS Flood levels on the Congaree River as of Dec. 2015.

Contrary to popular assumption, the term “1,000-year flood” does not describe the highest water levels in 1,000 years; it means that statistically, there is one chance in 1,000 of a flood of that magnitude or greater occurring in any given year (Holmes).





# The Damage

This sudden surge through our waterways wreaked much havoc on the water supply systems in Columbia. Many tributaries flowing into the three rivers were engorged at record levels.

The Gills Creek Watershed crossing under Garners Ferry swelled over the previous record of 9.4 feet to an estimated 19.6 feet (“Historic October”). The Columbia Fire Department tweeted about breaking dams at Arcadia, Forest and Dogwood Lakes, urging people to stay safe and dry indoors (Columbia). The Columbia Canal at the convergence of the Broad and the Saluda Rivers was breached, leaving much of the city without running or drinking water.

Twelvemile Creek, which runs through the town of Lexington, was pelted by a foot of rain in 48 hours, causing the dams at Old Mill and Gibson Ponds to fail and floodwaters to enter downtown. The Dreher Shoals Dam at Lake Murray was opened for the first time since 1969 (“Historic October”). City operations maintained water distribution sites across Lexington and Richland Counties, partnering with Water Missions International to provide for those without running drinking water (“Developments”). Most customers had running water within a week of the worst of the flooding.

On Oct. 16, the State Department of Health and Environmental Control issued emergency orders to owners of 28 Richland County dams (75 dams statewide) requesting immediate inspection and improvement. The dam owners need to maintain lower water levels, or entirely empty their reservoirs to facilitate inspection, but failed to meet the DHEC deadline for appointing an engineer to carry out the inspections. As of mid-November, the agency had issued 24 official warnings to dams that failed to submit plans (Adcox).



*Above: Lexington Mill Pond from S. Lake Drive in downtown Lexington, October 2015. Below: Debris below the S. Lake Drive overpass, October 2015.*





# Before



Above: Fig. 5a: Screenshot of Google Street View, Lake Katherine from Woodlake Drive in Forest Acres, October 2014. Below: Fig. 5b: Screenshot of Google Street View, Gills Creek from Devine Street, September 2015.



# After



Above: Lake Katherine from Woodlake Drive in Forest Acres, October 2015. Below: Gills Creek from Devine Street, December 2015.





Roadways and interstates were greatly affected by flooding too. At its peak, a total of 541 roads and bridges were closed in the state, 130 of which were in Richland County, nearly 25 percent of all closings (SCDOT). There were two sinkholes and 17 roads or bridges washed out in Columbia, alone (Monk, “It”).



*Above: A manhole spews smelly overflow on Woodlake Drive, October 2015.  
Right: A section of Quail Lane in Forest Acres deteriorated by the  
flooding, October 2015. Opposite page: The amphitheatre on the Three  
Rivers Greenway in West Columbia, November 2015.*









And there were still more economic damages in the aftermath of the flood. Director of State Tourism Duane Parrish said the industry lost up to \$35 million in October, and suffered \$7 million in damages at state parks (Moore).

Although likely covered by insurance from the federal government, Hugh Weathers, commissioner of state agriculture, told The Post and Courier that crop damages amounted to \$300 million. But it was not just the infrastructure that suffered.

By Oct. 11 – exactly a week after the flooding began – the death toll hit 19 (“Flood”). Over a hundred water or flooded-vehicle rescue missions were carried out by law enforcement and safety officials, not accounting for the numerous cases of courageous citizens using their own personal watercrafts, everything from kayaks to speed and hunting boats. The National Guard made more than 3,000 high-water evacuations and distributed over 70,000 bottles of water (Moore). Twenty-five shelters sprung up to temporarily house 932 dislocated people (Chappell).

The city of Columbia had a mandatory curfew for a week after the flood subsided, because continued rain put excessive pressure on the already-taxed dams around the capital, and barricade removal continued to block the streets (“Developments”). There were even some reported cases of looting in northeastern neighborhoods (Brait).



*Left: A picnic area at Three Rivers Greenway in West Columbia, November 2015. Below right: The Three Rivers Greenway in West Columbia, from the Gervais Street Bridge, November, 2015. Below left: Granby Park, November 2015. Opposite page: Granby Park, November 2015.*









# Plans for repair

Repairs began instantaneously. The rain did not let up for a few days after the worst of it, with state officials and military personnel on high alert for potentially failing dams in and around the Columbia area. Initial damage estimates from the SC House Ways and Means Committee show that the flood cost South Carolina \$40 million in the emergency operations of the National Guard and the State Emergency Management Division.

Although FEMA will reimburse 75 percent of the expenses, this estimate does not include the significant damage to roads and bridges (Cope). South Carolina will have to pay \$9.3 million to cover the National Guard assistance, but even with help from FEMA, will need to fork over an additional \$25 million to fix the Columbia Canal, a project estimated to total \$100 million (LeBlanc).



*Above: Repairs begin at Gibson Pond, November 2015. Right: The Lake Katherine cleanup, October 2015. Opposite page: Above: Sandbags, October 2015; Below: The breached dike is filled, October 2015.*





The State newspaper reports total costs have been estimated at around \$132 million, according to City Manager Teresa Wilson, and the city is having trouble securing where exactly those funds will come from (LeBlanc). In lieu of increasing water and sewer rates that have already risen ten percent this year, Columbia has two options: it could seek short-term loans, or tap money reserves in the city's water and sewer accounts, allocating money in the budget for repairs to the city's facilities.

The city already faces a separate \$750 million tab for future repairs to the deteriorating sewer treatment structures (LeBlanc). Though the 60-foot hole in the dike of the Columbia Canal has been filled with sandbags and boulders, permanent repairs won't start until next year, The State reports. Missy Gentry, assistant city manager, says repairs could take as much as a year to complete (LeBlanc).





Repair to neighborhood dams and watersheds in Richland County could be complicated further, as at least four lawsuits have arisen against several organizations in charge of water systems since the middle of November. SCE&G and Lexington County have been named defendants in civil cases alleging negligence caused flood damage to both homes and businesses (Monk, “Flood”).

Complainants also allege that insurance companies are not footing the bill for damages that should be covered. Watershed operators in the northeast, like Lake Elizabeth Estates (that operates the Lake Elizabeth dam) and Carys Lake Homeowners Association (that operates the Carys Lake Dam), are defendants in cases blaming systemic failures in the Gills Creek Watershed resulted in the flooding of Forest Acres. The plaintiffs allege that there were obvious warnings made before the flood, and those operating the dams and creeks failed to make proper preparations and repairs (Monk, “Flood”). More lawsuits are expected to come as dam assessments are made and damage is tallied.

And for some who suffered damage to their property or who completely lost their homes, reconstruction is not an easy process. There have been several cases of FEMA aid falling short of compensation, which has a limit of \$33,000 per household. Only 28 percent of 90,000 FEMA cases across the state have received aid, and FEMA has already approved nearly \$68 million in disaster relief (Wilks). The Small Business Administration is also offering loans to home- and businessowners across South Carolina, having approved \$29.2 million in Richland County thus far, the most in the state. The SBA loans up to \$200,000 per household to repair or replace





housing, and \$40,000 per household to replace personal property (Wilks). But even with these agencies, numerous ministries and food banks, and the food stamp program, for many people in Columbia the flood is a major financial setback.



*Above: Burwell Lane, October 2015.  
Right: Forest Acres cleanup, October 2015.  
Left: Lake Catherine insurance agent, October 2015.  
Opposite page: Forest Lake, October 2015.*



*water level on a Forest Acres home  
following the flood*

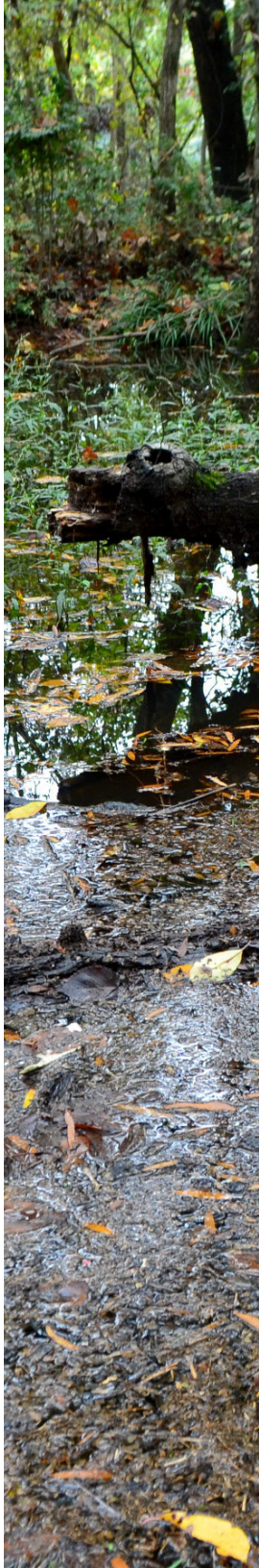






Above, left: Woodlake Drive, October 2015.  
 Above, right: Rickenbaker Road, October 2015.  
 Left: Kilbourne Road, Columbia 2015.









# Making the Shots: the Afterword

The flood was a very sudden event. Many roads and neighborhoods were choked to inoperable states. Most of the bridges over the Congaree and into downtown were blocked off, and Gills Creek had risen over Devine Street in the worst of it. I live downtown on Wheat Street, but I did not start venturing out to make photos until a few days had passed, heeding the barricades and PSAs. I was not going to endanger myself or anyone else in this process.

Capturing moments of the flood as it was happening and as it was altering the landscape was very touch-and-go. I was successful at getting shots by walking the bridges and roadways near the city's canals and dams, often taking paths not easily traveled. Many of my shots come from the Three Rivers Greenway in the Vista, at the Columbia Canal, the West Columbia Riverwalk and Amphitheatre, and Bicentennial Park near the Carolina Baseball Stadium. Many public accesses to the river were of course closed, like at the Cayce Riverwalk, Three Rivers Greenway, Saluda Shoals, Riverbanks Zoo and the Botanical Gardens. But I had as much time as I needed in the private neighborhoods like Forest Acres, near the lakes, and Timberlane Drive, southeast of downtown off Beltline Boulevard. There, it was more a question of how long I wanted to document people's misery in front of them. I was sharply dismissed by one woman after she discovered my photographs were not for submission to her insurance representative.

"Who do you think you are? Can't you see we've been through enough? I need you to leave the front of my property immediately."

She seemed to think I would profit from her loss. And in fact there were cases of looting, burglars taking from what all that was left of one's possessions. I try to make sure I get close enough to get the shot, but not to feel like I am imposing on someone's privacy. I just cannot imagine what it must feel like to have all your possessions destroyed by a torrent of water. In looking at all the destruction, it got heavy to even bear the photographs. But that is when I began to remember what is truly important.

During times of devastation and loss, it is always important to remember to be grateful for what you still have, to be grateful for the helpers, and to contribute in any way you can. Columbians and South Carolinians banded together during this trying time, and I hope we will continue to repair the state and its cities with pride. The photographs I made of the destruction to private homes are very telling of the impact on people let in the wake of the flood. Two months later, and some streets are still impassable. I tried to capture the larger pictures, of the damage to the water systems and facilities, of the roads and bridges, but also of the human lives affected by the water's destruction.

Thank you to all who guided my project. And thank you to all who helped the relief efforts. May your light continue to shine.



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